Voyager Bulletin

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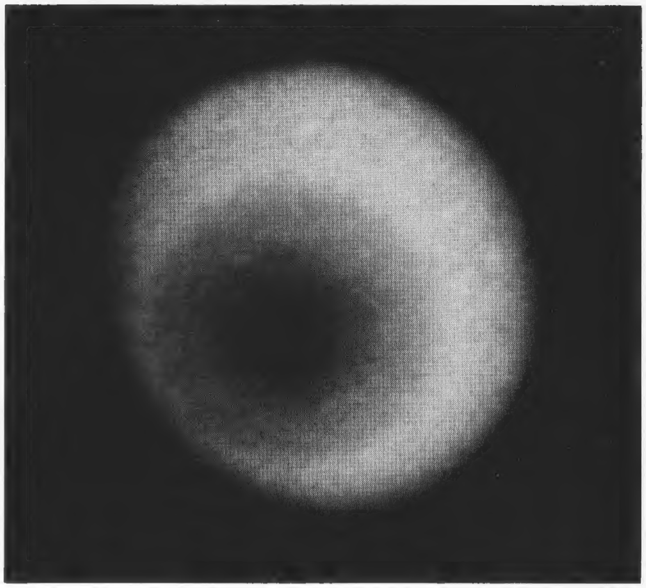
A Sixth Moon Discovered

A new moon orbiting Uranus has been discovered in images taken by Voyager 2 on December 31, 1985.

Voyager imaging team scientists found the small moon in long-exposure images of Uranus and its rings taken by the narrow-angle camera. Conclusive evidence of the satellite's orbit was seen when the spacecraft was about 31 million kilometers from Uranus.

The new satellite, designated 1985 U1, is the sixth known to orbit Uranus. It is about 75 kilometers in diameter, and occupies an orbit 86,000 kilometers from the center of the planet, between the moon Miranda and the outermost of Uranus' nine known rings. The moon orbits Uranus every 18 hours, 17 minutes, 9 seconds.

The spacecraft's flight path has been planned to pass between the rings and Miranda. The new moon will not be in a position to endanger Voyager 2 as it passes the planet.



This Voyager 2 photograph of Uranus is the first picture to show clear evidence of latitudinal banding in the planet's atmosphere, and one of the first to indicate atmospheric structure of any sort. The computer-enhanced picture is a summation of five images returned December 27, 1985 by Voyager's narrow-angle camera. The spacecraft was 36 million kilometers (22 million miles) from Uranus.

The concentric pattern emanates like a bull's-eye from the planet's pole of rotation, which in this view lies left of center. (Uranus lies almost on its side with respect to the other planets and is rotating in a counterclockwise direction as seen here.) Clouds in the Uranian atmosphere give rise to the pattern, the first clear photographic evidence of banding similar to that seen previously on Jupiter and Saturn. The banding on Uranus, however, shows much less contrast. At the distance at which the images were acquired, Voyager's camera could have detected individual features as small as 660 kilometers (410 miles) across, but no such clouds or markings were apparent.

Scientists cannot yet say what properties — such as cloud height, composition or particle size — are giving rise to the varying levels of brightness visible here. The images composing this picture were shuttered through a filter that transmits only violet light. In the original, unprocessed images, the contrast of the features producing the banding is low, no more than 10 percent. In order to reduce "noise" and enhance the visibility of the features, processors at JPL combined five raw images and then compared the resulting composite to a hypothetical featureless planet illuminated by the Sun from the proper direction. Only the ratio between the original data and the hypothetical image is shown.

Observatory Phase Ends, Far Encounter Begins

While the planet Uranus still appears to be a uniformly colored disk in the images received from the spacecraft, vague atmospheric features are now visible in specially processed images of Uranus's southern hemisphere. Multiple images taken in late November and December have been added together, computer-processed, and enhanced. The pattern is most pronounced in violet-filter images as a dark polar area surrounded by a grayish circle and then a whiter area. Assistant project scientist Ellis Miner speculates that the brightness difference may be due to a high-atmosphere polar haze that reflects less sunlight than the cloudy non-polar regions of the atmosphere.

Voyager 2's ultraviolet spectrometer has also seen the planet for the first time. The instrument first detected Uranus on December 18–19 at the hydrogen lyman alpha wavelength, 1216 angstroms.

The planetary radio astronomy instrument still has not detected natural radio emissions that were expected from the planet.

Daily system scans and auroral searches in the ultraviolet continue, along with various calibrations, computer checks, and optical navigation imaging. The "far encounter" phase began on January 10.

On December 23, the spacecraft performed a trajectory correction maneuver, firing hydrazine gas from its thrusters for 14.5 minutes to adjust its aimpoint at Uranus by about 340 kilometers. The spacecraft was accelerated by 2.1 meters per second. The change in aimpoint was necessitated by a refinement in the knowledge of the mass of the planet, which is now believed to be 0.3 percent larger. This upward shift was necessary to better fit recent optical navigation data. Greater mass translates to greater gravitational effects on the spacecraft's flight path, so the aimpoint was moved farther from the planet.

As a result, the flight team is making minor yet important changes in the near encounter sequences since the approach geometry and the relative timing of specific events will change slightly. For example, closest approach to the satellite Miranda will occur 92 seconds earlier than previously planned. Since the spacecraft will be tracking the satellite to reduce image blurring, the spacecraft's antenna will be pointed away from Earth and thus there will be no communications link at that time. However, it will be important to regain the communications link quickly in order to use the radio data to determine the mass of Miranda.

A trajectory correction maneuver will be made January 19, to fine tune the approach to Uranus.

Uranus Science Experiments – Planetary Radio Astronomy

The planetary radio astronomy (PRA) team works with a remote-sensing instrument designed to detect radio emission signals. Two 10-meter-long whip antennas are mounted on the spacecraft bus at a 90° angle to maximize the directivity of the antennas. The planetary radio astronomy and plasma wave experiments share the same antennas and their electronics are mounted piggyback.

During the past years of cruise to Uranus, the PRA team has been studying solar radio emissions. Voyager 2 makes an effective solar radio observatory partly because of its longevity. Although solar activity is currently at a low in its cycle, Voyager 2 has detected several solar flares in the last year and uses them for calibrations.

At Uranus, the PRA will be listening for radio emissions from the planet. Such signals come from synchrotron emission in the planet's magnetic field and can thus be used to measure the rotation rate of the planet's core. The PRA will also measure radio emissions from auroras, phenomena that at Earth are caused by charged particles spiralling into the atmosphere along Earth's magnetic field lines. Static electricity and lightning may also be detected in the Uranian atmosphere. Radio emissions may be detected as the spacecraft crosses the ring plane, as well.

Principal investigator for planetary radio astronomy is Jim Warwick of Radiophysics, Inc., Boulder, Colorado. There are 14 co-investigators.

Plasma Waves

The plasma wave subsystem (PWS), using the same antennas as the planetary radio astronomy subsystem, is a local sensing instrument (i.e., it senses radio signals and phenomena in the immediate vicinity of the spacecraft rather than at a great distance).

The plasma wave instrument will detect and measure plasma wave interactions in the magnetosphere and detect interactions between the solar wind and the planet's magnetosphere. It can detect particles in the ring plane and measure their spatial density. It also measures continuum radiation, chorus, and ion acoustic waves in the magnetosphere, lightning and whistlers in the atmosphere, and upper hybrid resonances and electron plasma oscillations.

Studies of the planetary fields and particles environment are esoteric to many people, and Voyager scientists continue to look for ways to make their data more meaningful to the lay person. Data from the PWS can be processed by JPL's Multi-Mission Image Processing Laboratory so that phenomena not easily visible in black and white displays stand out in color. An example of this is the whistler phenomenon found in the atmospheres of Jupiter and Saturn. In addition, the signal from the PWS can be played audibly. The instrument is so sensitive that it detects electronic switching in other instruments on the spacecraft. In audio tapes, one can hear the thrum of the spacecraft's main power supply, the ping as attitude control thrusters fire, and the ringing as other instruments operate. As the spacecraft dived through the ring plane at Saturn, the PWS received signals that sound in the audio tape as though the spacecraft were being pelted with driving rain.

Both Voyager spacecraft are also looking for the heliopause, the edge of the Sun's magnetic influence. By some definitions, this is the edge of our solar system. PWS data in late 1983 and early 1984 indicate that Voyager 1 may be nearing this boundary, and may cross it as early as 1991; other estimates of the heliopause location would place Voyagers 1 and 2 passing this boundary closer to the end of the century. Voyager 1's flight path is taking it above the ecliptic plane at an angle of about 35°. Although Pioneer 10 is now the farthest spacecraft from the Sun, it is heading down the Sun's magnetotail and is not expected to exit the heliosphere in that direction for decades.

Principal investigator for the plasma wave investigation is Fred Scarf of TRW, Redondo Beach, California. There are two co-investigators.

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